

WATERSHED SCIENCE AND TECHNOLOGY

Mission

The mission of the National Energy Technology Laboratory's Watershed Science and Technology Initiative is to provide tools for assessing watershed issues and solving watershed problems.

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The National Energy Technology Laboratory (NETL) – a field office of the U.S. Department of Energy located in Morgantown, West Virginia, and Pittsburgh, Pennsylvania – is noted for its scientific, technological, and administrative expertise. NETL's Watershed Science and Technology Initiative provides science-, technology-, economic-, and information-based approaches, products, and services. These tools enable regional and national stakeholders to systematically and objectively assess watershed issues and solve watershed problems within a watershed management framework. NETL provides coordination and technical assistance, policy and impact analyses, research capabilities, and information and education assistance.

*Providing
Technical
Resources
for Enhancing
the Region's
Living
Environments*



Focus Areas

NETL's focus under the Watershed Science and Technology Initiative is in two key areas:

Watershed Management is an initiative that provides (1) information to and coordination among Federal agencies and other interested parties, and (2) management support and expertise in developing, promoting, implementing, and overseeing watershed projects to assess, maintain, and restore ecosystem health.

Water Treatment Technology is a research and development program that develops and demonstrates watershed characterization tools and treatment technologies to restore and maintain watershed resources.



Partnerships

A watershed management approach means that all stakeholders—citizen action groups; industry; academia; state, tribal, federal, and local governments; and the general public—work together to identify problems and implement solutions. NETL has formed alliances with divisions, departments, or chapters of:

- The U.S. Environmental Protection Agency (EPA)
- The U.S. Department of the Interior's National Park Service (NPS)
- The U.S. Department of the Interior's Office of Surface Mining (OSM)
- The U.S. Army Corps of Engineers (USACE)
- The U.S. Department of Agriculture (USDA)
- The States of Maryland, Pennsylvania, Virginia, and West Virginia
- West Virginia University
- The Animas River Stakeholders Group
- The Appalachian Clean Streams Initiative
- The Canaan Valley Institute
- The Chartiers Creek Watershed Coalition
- The Headwaters Charitable Trust
- The Interstate Commission on the Potomac River Basin

Success Stories

Watershed Remediation at the National Park Service's Big South Fork National River and Recreation Area

The National Park Service's Big South Fork National River and Recreation Area is located on the Cumberland Plateau in southeastern Kentucky and north-eastern Tennessee. The Big South Fork Region has been extensively mined for coal since the early 1900s; some mines are still operating in the Big South Fork watershed. The coal spoils and pyrolyzed gob piles that have been deposited in the floodplain continue to be a source of metal-laden acidic drainage. Aquatic life in the river has been adversely affected by depressed pH levels and elevated concentrations of metals in the water and in sediment columns of the river.

NETL is providing technical assistance and project management support to the National Park Service to help characterize, prioritize, and remediate the adverse environmental impacts of abandoned mine discharges on the Big South Fork watershed. A 3-year investigation, designed by the National Park Service and NETL, has been completed that identifies, characterizes, and prioritizes water quality impacts resulting from contaminated mine drainage (CMD) in a heavily impacted 12-mile portion of the Big South Fork. The products from that investigation include an inventory of all CMD sites within the park, a prioritization of the sites relative to their direct impact on the Big South Fork, and conceptual designs for site remediation methods that will most improve water quality in the river. Remedial projects and best management practices that have been considered include passive wetland treatment systems, anoxic limestone drains, lined channels, and removal of spoils or gob piles. Based on these considerations, the National Park Service is now ready to initiate the remedial phase for selected CMD sites. NETL is providing technical direction and procurement services for a set of solicitations that will provide professional engineering and construction services to remediate the selected priority sites.

Geophysical Applications

NETL has successfully applied surface geophysical techniques for remote characterization of contaminant sources, including surface and underground mines. Electromagnetic terrain conductivity, magnetometry, and very low frequency techniques have all been used. Successful applications include pinpointing water-filled fracture zones on land and beneath rivers and streams that serve as recharge zones for acid-producing underground mines. The techniques have also been used to locate buried acid-producing pyritic material that was polluting groundwater near reclaimed surface mines, and to identify underground hazards. Recently, NETL used these techniques to locate mine entries of an unmapped coal mine in Maryland, to track the path of injected fly ash grout in an abandoned underground mine in West Virginia, and to locate recharge zones and contaminant sources in southern Colorado.

Fishtrap Lake Mine Fire Project

Fishtrap Lake is a 16.5-mile-long lake located in Pike County, Kentucky, that was developed by the U.S. Army Corps of Engineers (USACE) in the 1960s as a flood control project for Levisa Fork, a key regional river. The lake also serves as a significant recreational resource for the public. In the fall of 1991, forest fires ignited exposed coal seams along the northern boundary of the lake. Since then, the fire has burned along unreclaimed highwalls, within auger openings, and in abandoned underground mines. Approximately 800 acres of mined lands continue to burn. Fires and related environmental impacts have caused portions of project lands to be closed to the public. The USACE asked NETL to provide an evaluation of mine fire conditions and abatement alternatives. NETL's team of mine fire and environmental experts performed an assessment of the site and provided recommendations to the USACE on near-term actions related to the mine fire and on a local mining company's proposal. Recommendations were also made to view the problem from a watershed perspective and to develop a comprehensive future use/management plan for the facility.

Chemical Treatment of Contaminated Mine Water

Not all mine water can be treated with passive technology. For water that is either too acidic or too high in volume, chemical treatment is necessary. NETL has developed an effective and economical alternative to conventional treatment systems: the In-Line System (ILS). The ILS contains no moving parts, is simple to install and operate, and its flow capacity is flexible. Cost savings of over 30 percent have been realized by replacing conventional chemical treatment with the ILS, principally because better aeration and mixing reduces the use of chemicals. Water-powered ILS installations are also possible; NETL is cooperating with the Pennsylvania Department of Environmental Protection and the U.S. Geological Survey to evaluate alternative water-powered treatment technology for use at abandoned mine sites in the anthracite mine field in eastern Pennsylvania.

Passive Treatment of Contaminated Mine Water

Water from abandoned mines may be the single greatest water pollution problem in this area of the country. NETL personnel pioneered the use of passive technologies such as constructed wetlands to address this problem. The idea that systems could be constructed to treat this water without continuous addition of chemicals or high maintenance was extremely attractive to state reclamation agencies, watershed associations, and even the mining industry, which is now constructing passive treatment systems at active or newly reclaimed sites. Well over a thousand passive treatment systems have now been installed using the guidelines and guidance provided by NETL scientists. These systems now include anoxic limestone drains and sequential alkaline producing systems in addition to constructed wetlands. These efforts received the Three Rivers Environmental Award in 1995 from the Pennsylvania Environmental Council in recognition of their regional benefits. NETL continues to be active in this field and provides guidance and technical assistance to state and federal agencies.

Technical Assistance for Local Watershed Associations

Using a variety of funding sources, NETL has provided a range of technical assistance to a number of watershed associations. Our efforts have helped these associations install low-cost water treatment systems, and have enabled them to attract additional funds for remediation efforts. We have installed experimental aeration systems to promote iron oxidation at sites near New Stanton, Pennsylvania, where metal contamination problems exist, and we recently entered into an agreement with the Peter's Creek Watershed Association – which adjoins NETL's Pittsburgh campus – to help them inventory and evaluate their pollution sources. We are arranging for an aerial reconnaissance of the lower Youghiogheny River and one of its tributaries, Sewickley Creek, to assess and prioritize contaminant sources in those watersheds.

Mountain's Promise Program

In September 1997, NETL was asked by the County Commission of Preston County, West Virginia, to help design a county-wide watershed improvement program. After holding public meetings and reviewing available funding sources, the county submitted an application for an AmeriCorps grant to the West Virginia Commission for National and Community Service. NETL provided facilitation and logistical support to bring together some 20 regional governmental, industry, and community organizations in a consortium to design and commit resources to the program. In July 1998, AmeriCorps awarded the county a \$147,000 per year renewable grant that will be matched by \$35,000 in county funds and \$60,000 in partner commitments. Twenty AmeriCorps volunteers will lead community groups in building wetlands, monitoring and removing litter from streams, planting trees, and raising the community's knowledge of the challenges to their watersheds. NETL will provide technical assistance for the duration of this multi-year project.

Partnerships (continued)

- The Mill Creek Coalition of Clarion and Jefferson Counties (PA)
- The Peters Creek Watershed Association
- The Schuylkill County (PA) Conservation District
- The Sewickley Creek Watershed Association
- The Shamokin Creek Restoration Alliance
- The Slippery Rock Watershed Coalition
- The Stoneycreek River Improvement Project
- The Swatara Creek Watershed Association

NETL will partner with all organizations working to assess and solve the diverse problems facing our nation's water resources.



7,500 miles of Appalachian streams are impacted by acid mine discharge

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Capabilities

NETL's capabilities in support of the Watershed Science and Technology Initiative include the development, design, and evaluation of active and passive water treatment systems, as well as at-source avoidance and remediation options for a range of water pollution problems, including active and abandoned mining operations. In addition to scientific and technical expertise, NETL personnel have extensive experience in project design and management, cost estimation, procurement, legal affairs, public participation, and on-site supervision. NETL successfully manages a wide range of projects, from small clean-up projects to large-scale construction projects. NETL provides independent environmental project and business management reviews and technical assistance to government agencies, industry, and public environmental groups. Some of our specific capabilities are outlined below.

Watershed Characterization and Impact Analysis

- We analyze long-term effects of current and potential discharges from large abandoned and inactive underground coal mines on key regional rivers, including addressing underground mine pool issues.
- We apply watershed characterization models, recommend frameworks for watershed impact models, and identify and evaluate tools for cumulative watershed impact assessment.
- We conduct non-intrusive geophysical analyses to locate water-filled fractures and trace the flow of injected materials into underground mine voids.
- We integrate geophysical methodologies for watershed characterization obtained by air- and land-based methods.

Watershed Restoration

- We develop practical remediation alternatives for addressing discharges into watersheds from point and non-point sources.
- We physically conduct field demonstrations using both state-of-the-art and conventional treatment methodologies for restoring watersheds.

Watershed Economics

- We provide cost engineering and cost benefit analyses, prioritization of alternatives (decision-making support), and natural resource valuations.

Pollution Prevention

- We assess the feasibility of stabilizing animal waste and using this waste as a fuel source or as a component of construction materials.
- We investigate using power plant combustion by-products, such as fly ash, for controlling water pollution problems and waste stabilization.
- We evaluate potential methods to stabilize and reduce the volume of sludge produced during water treatment processes.



Education, Outreach, and Information Management

- We conduct and support educational and outreach activities to help stakeholders develop and implement plans for watershed characterization, remediation, and monitoring/evaluation activities, particularly at the grassroots level.
- We serve, from inception to post-remediation monitoring and evaluation, as a technical resource to help stakeholders prepare technically sound grant proposals and/or implementation plans for watershed characterization, remediation, and monitoring/evaluation activities.
- We have an expert geographical information system and other information-processing capabilities that can be used to analyze and present watershed information.